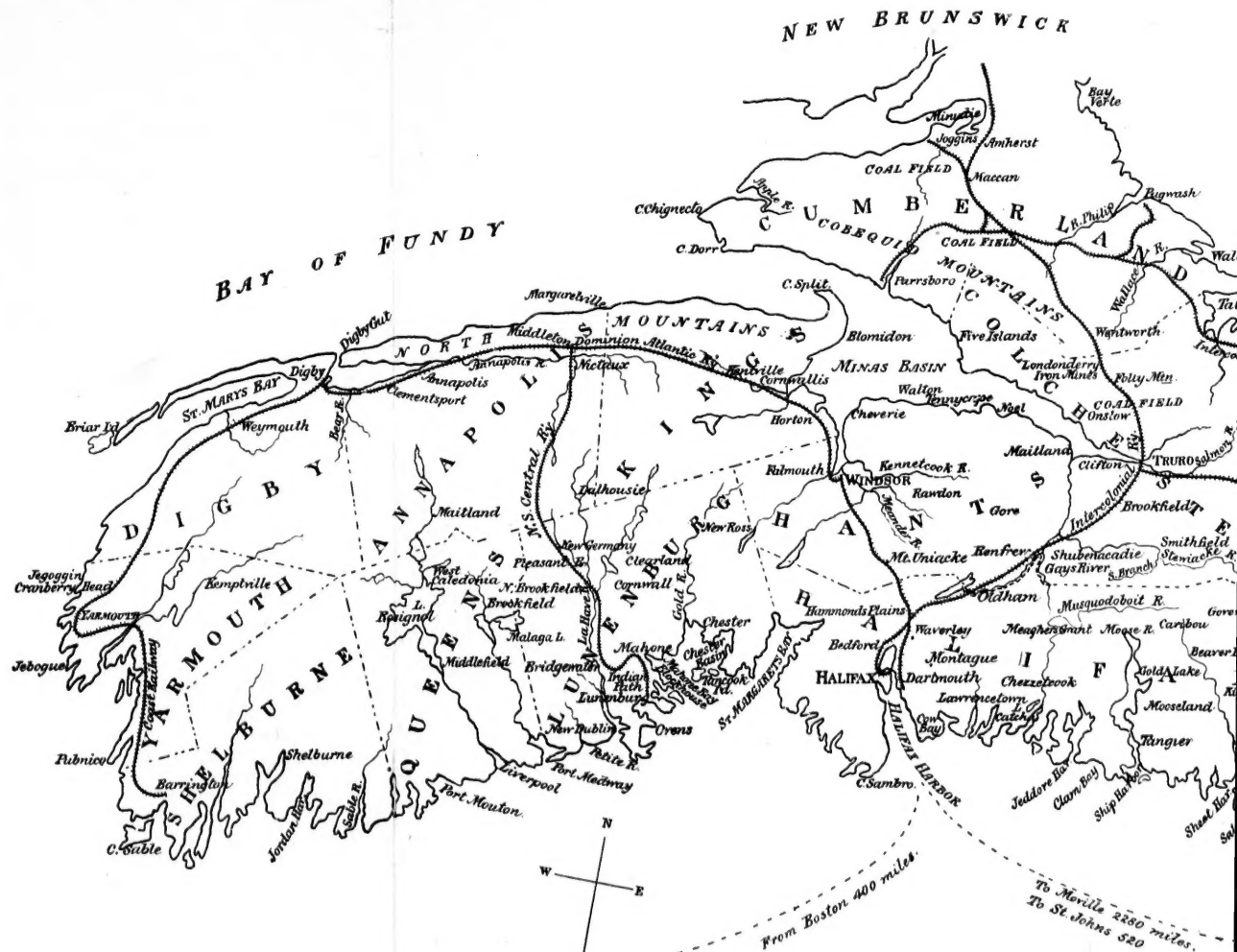




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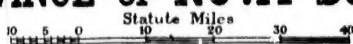
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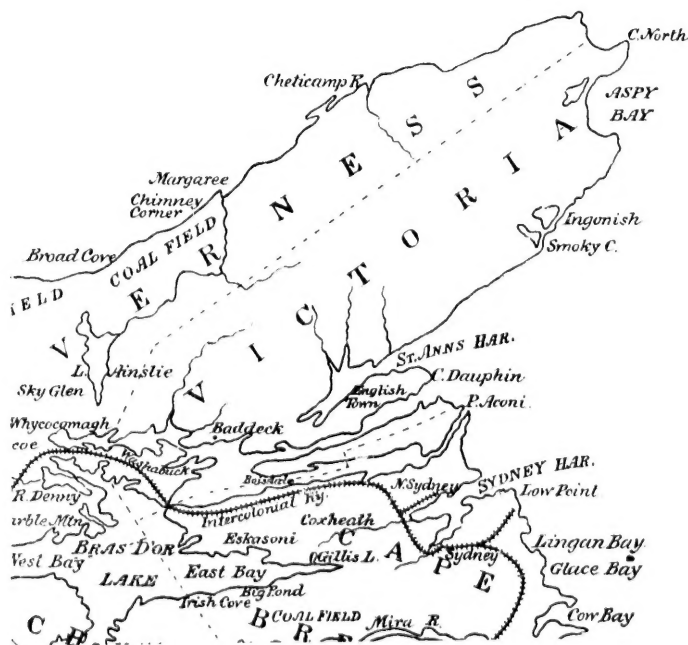
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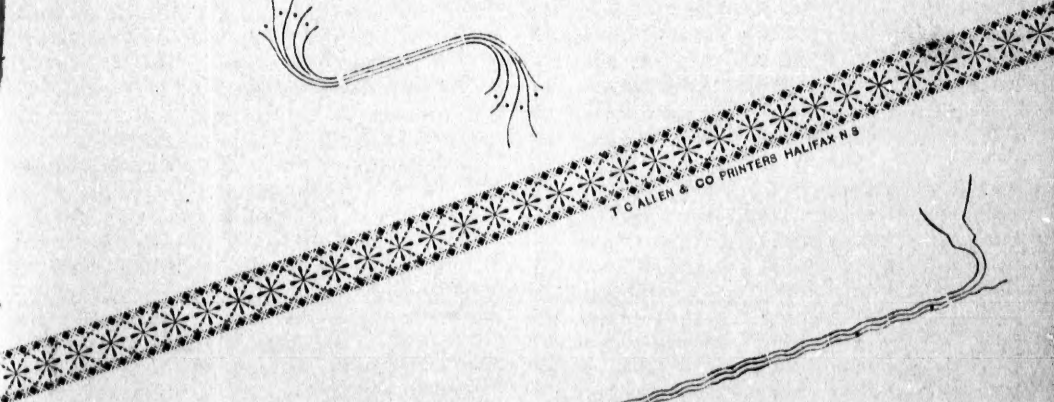
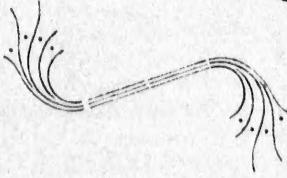
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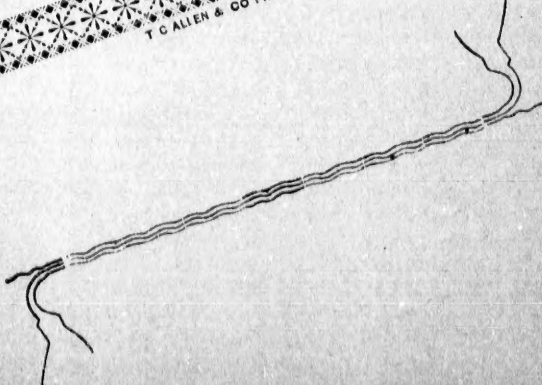


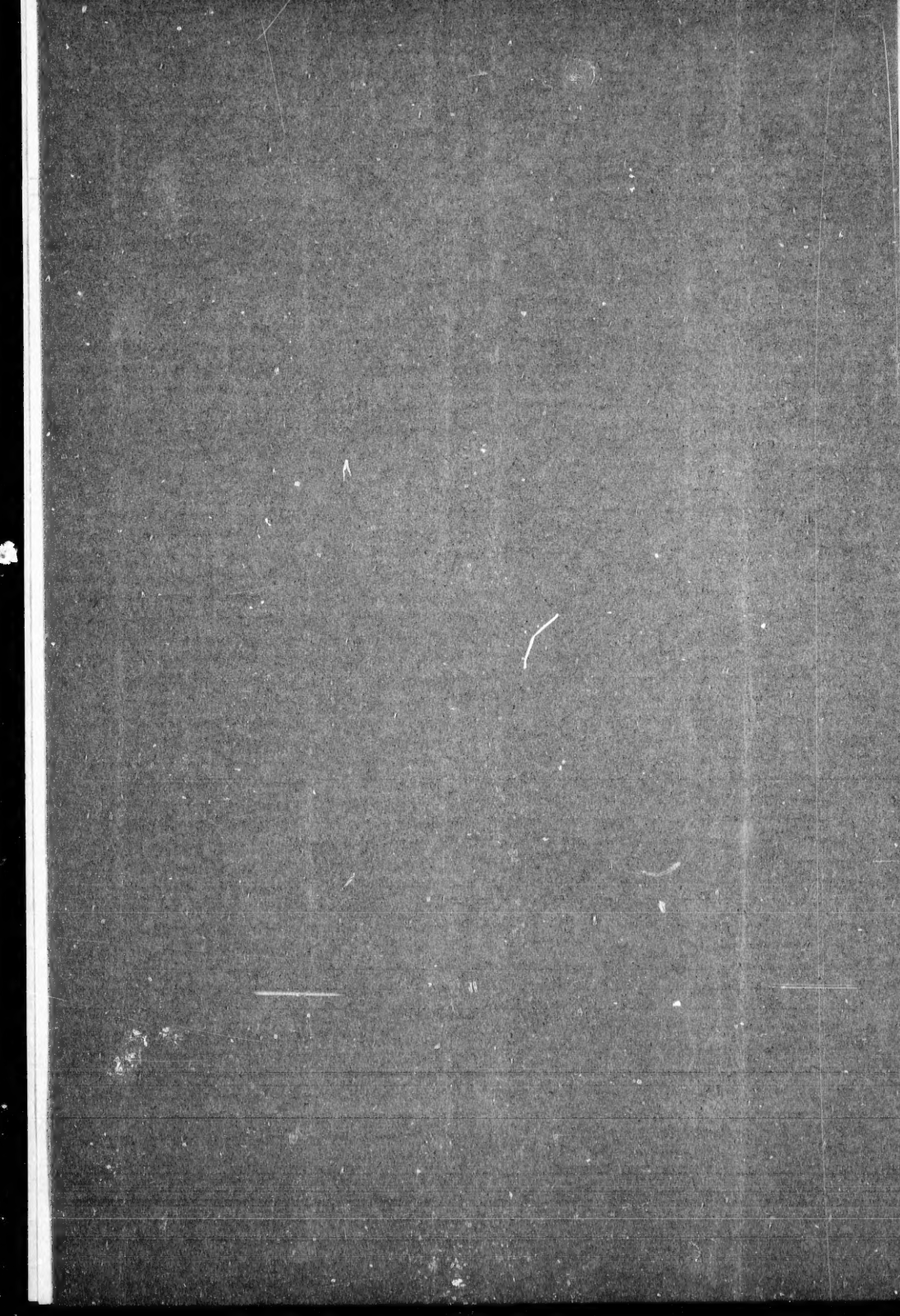
ORES OF
NOVA SCOTIA.



GILPIN.

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ORES
OF
NOVA SCOTIA.

GOLD, LEAD, AND COPPER.

BY
E. GILPIN, JR., M. A., LL.D., F. R. S. C., ETC.

INSPECTOR OF MINES.



HALIFAX, N. S.
COMMISSIONER OF PUBLIC WORKS AND MINES,
QUEEN'S PRINTER,
1898.

1898
(13)

HALIFAX, N. S., June 20th, 1898.

The Honorable Charles E. Church,
Commissioner of Public Works and Mines :

SIR,—

The report herewith submitted on the Gold, Lead, and Copper deposits of Nova Scotia, contains, in an abbreviated form, the most important facts respecting their value and extent that I have been able to collect from public and private sources. The subjects treated merit much greater detail than the space at my disposal admits of, but I trust that the brief notice given them will show that they are valuable, and capable of almost unlimited development.

I remain, sir, yours obediently,

E. GILPIN, JR.

INTRODUCTORY.

The following remarks on the Gold, Lead, and Copper deposits of Nova Scotia have not been written from a technical or scientific point of view ; but are intended to convey in a practical manner a fair idea of their extent, value, and adaptability for profitable mining.

The lead and copper deposits are as yet undeveloped, although they are wide spread and promising. The gold deposits, alluring from their display of free gold, have received locally much attention. This attention, as may be gathered from my brief remarks, has not been for many years of an encouraging nature, as it was an affection of the hope of immediate returns, and not an endeavor to reduce gold mining to its true position, a commercial enterprise.

Until a few years ago the local capitalist wanted something rich, a fortune without labor, extracted from a golden bunch of quartz or from the pocket of an innocent investor. Now, however, the fact is recognized that gold mining is a business, not necessarily a roseate speculation ; and veins and deposits are being profitably worked, on business principles, which, a few years ago, would have been spurned. Since this principle has been accepted it is safe to say that the gold interests of the Province have an assured future.

The guarantee of this is the fact that we have local investors who can mine and mill quartz profitably, on a small scale, when the quartz crushed does not yield over two dollars of free gold per ton.

This cheapness of mining and milling may confidently be quoted as a most important item in the problem of the profitable development of our lead and copper deposits.

NOVA SCOTIA GOLD FIELDS.

The gold fields of Nova Scotia became known about the year 1860.

The earliest discovery was followed by numerous others, until it was at first believed that it was all auriferous. Gradually however, it became evident that the workable deposits of free gold were confined to the Atlantic half of the Province. Investigation showed that this district was occupied by two divisions of rock, granite and slates, and quartzites or sandstones, compacted by a silicious cement, and locally known as "whin". Geologists referred the latter to the Lower Cambrian age, a series of rocks known to be auriferous in other parts of the world.

In Nova Scotia they are divided into the lower or quartzite group, and the upper or ferruginous and graphitic slate group. The lower group, to which a thickness of over 11,000 feet is assigned by Mr. Faribault, consists principally of quartzite, interstratified with numerous beds of slate varying in colour and texture, and with a few beds of compact conglomeritic rock. The upper group, which is over 4,000 feet thick, is almost wholly composed of bluish black soft slates.

By the labors of Mr. Faribault, the pioneer of the Geological Survey in the mapping of the gold fields, much detailed information has been collected, and I am indebted to him for his clear presentation of the most interesting facts relating to the stratigraphy of the rocks under consideration.

These measures, originally horizontal, have been moved by a powerful and uniform pressure from the south, exerted in a line roughly parallel to that of the coast, which has folded them into a series of sharp parallel undulations or folds. By denudation these folds have been so worn down that in a generally level country they have been extensively exposed in horizontal sections, showing within a few hundred yards the reverse dips, to the north and to the south. The rocks generally dip at an angle of 75° to 90° , seldom lower than 45° , and overturns are frequently noted.

Following the definition of the extent of the gold fields of the province as given by the early writers, it would be put down at about 6,500 square miles. Various deductions have been made from this on account of the granite masses which are frequently met. The granite is of an age, roughly speaking, geologically referred to a period later than the Devonian.

Generally the estimates allow that about one half of the auriferous district is occupied by granite, making the extent of the gold fields about 3,000 square miles. The granite is presented in masses and dykes of varying shape and size, and appears, broadly speaking, to have melted through the slates and quartzites. The granite is not generally considered to be auriferous, although gold has been found in quartz veins in it at points far distant from the slates and quartzites.

The upper or slate group is not recognized by miners as auriferous, although quartz veins occur in it, and sometimes show gold. It may be found, however, on further examination, that at favorable localities extensive deposits of low grade ores are presented in it.

Attention has therefore been confined principally to the lower or quartzite group. From Mr. Faribault's observations it appears that the gold belts occur at a distance below the base of the upper or slate group, varying from 2,800 to 8,000 feet, giving a thickness of about 5,000 feet of auriferous strata. Veins occur at other points in the lower group of rocks, but have not yet been found to be pronouncedly rich in gold.

It will therefore be seen that wherever this section of the lower group has been folded, denuded and exposed, there the best fields are opened for exploration and work. Eleven of these auriferous anticlinals have been defined between Sheet Harbor and Caledonia. There are many others succeeding these, starting from the shore and passing obliquely away from it. The district to the eastward of Halifax has been carefully mapped by the Geological Survey, and the courses of these auriferous anticlinals laid down approximately between the points where they are known exactly by mining operations. These maps are on a scale of one mile to the inch, and give minute topographical details, so that the localities where prospecting can be most advantageously carried on are readily observed. In order that information may be available as to the district lying west of Halifax, Professor Bailey has examined in less detail, the counties of Lunenburg, Queens, Shelburne and Yarmouth. In these districts there are larger quantities of granite, but the same general structure is preserved. The maps and reports relating to the

gold fields are invaluable to gold miners, and can be obtained by payment of nominal prices from the office of the Canadian Geological Survey at Ottawa.

The quartz veins of Nova Scotia occur in these anticlinals intercalated between the layers of quartzite and slate as beds running parallel with the strata. They are seen to turn on their course where the anticlinal axis has become depressed, and underground operations have shown them rising up on one side and dipping down again on the reverse side, without a break in their continuity, or giving any surface indication of their existence. They extend in many cases for thousands of feet, and have been followed to depths of seven hundred feet in their vertical extension. In size they vary from an inch up to twelve or fifteen feet, many of the most productive are from six to fifteen inches in thickness. They present in spite of their bedded position, many of the characteristics of typical veins. Their essential ingredient is quartz, varying in texture and color: in many of the more productive veins presenting a smooth surface and bluish shade. There is always present a varying percentage of iron, copper, lead and zinc sulphides and traces of other minerals. Cross or fissure veins also occur at Rawdon, Caribou, Blockhouse, Oldham, Brookfield, etc., and are frequently productive.

The gold is present characteristically in the free state as irregular masses, varying from microscopic particles to irregular patches, often several ounces in weight. It is also present in films covered by the metallic accompaniments, and as invisible particles in them. There are also quartz veins almost free from sulphides, etc., yielding gold in workable amounts; although it is not visible. But little attention has yet been paid to this class of veins, unattackable by the ordinary quartz mills, although adapted for chemical treatment by the more modern systems. In the veins the gold is sometimes distributed with comparative uniformity over considerable areas; usually however, it is more or less concentrated within certain defined limits, leaving spaces on each side comparatively barren. These enriched zones are known as pay streaks, are repeated in some veins, and follow certain laws not yet clearly understood. They have hitherto been the principal source of the gold production.

Gold is also found sparingly in the quartzite beds and more abundantly in the slates. The latter when in contact with the quartz frequently show it in thin platings, and the small veinlets of quartz seaming the slates often carry gold. When one or more quartz veins occur in connection with a slate bed, the whole bed is frequently rich

enough to be worked as a low grade ore. As will be shown further on, practical experience has taught the miner that profitable low grade ore means material yielding in an ordinary stamp mill from two dollars to the ton and upwards. The continuity of the anticlinal axes are broken at some points by faults of great extent; smaller faults are met in the veins, but considering the age of the strata they are unusually uniform and free from disturbance.

ALLUVIAL GOLD MINING.

The early prospecting developed promising alluvial deposits at several points. At Tangier it was shown that a large extent of surface carried gold, and several hundred ounces were washed out. The limited extent of the areas, however, did not allow of systematic work, and attention was diverted to the rich vein outcrops. The most interesting alluvial development was at the Ovens, near Lunenburg. Here the sea has worn a number of large cavities in the cliffs which are composed of soft slates with small quartz veins often showing gold. The action of the waves concentrated the gold washed from the slates along the beach near these openings, and during the years 1861 and 1862, about 2,500 ounces were returned as taken out. It is believed, however, that only a small part of the gold extracted was accounted for. Since that date small amounts have been secured by persons living in the vicinity. The richness of the alluvium directed attention to the neighboring quartz veins, but they proved uncertain and unprofitable with the crude methods of that day. Trial crushings of the quartz and slate from several points in this district would indicate the feasibility of dealing with them on a low grade basis.

At Gay's River explorations have shown that a conglomerate of lower carboniferous age, lying on the gold bearing slates, carries at its junction with them considerable amounts of gold. At one time profitable mining was carried on here on a small scale along the edge of the outcrop of the conglomerate; but the miners turned their attention to richer districts. As the conglomerates at many points in this district show gold it is to be regretted that more attention has not been paid to them, as in a certain degree a parallel can be traced between them and the South African gold fields.

Promising alluvial ground exists on the Nine Mile and Meander Rivers, at Renfrew, in the southern part of Waverly, and in the vicinity of other gold fields. In fact at any favorable point south of the passage of an auriferous anticlinal sights of gold can be obtained

by panning, which would in California or other countries where alluvial mining is a recognized practice, lead to immediate attention.

However, little attention has been paid to this source of gold for many years, although it has been well within the knowledge of miners that in every district the immediate surface cover contains much gold in boulders and free in the earth. At Moose River, Mr. Touquoy, a miner who acquired his experience in Australia, has for a number of years systematically passed the surface earth of his areas through his crusher with profitable returns. There can be no doubt that at many points this system could be advantageously united, as in his case, with the crushing of underground quartz.

It is true that in this province there may not be the enormous deposits of auriferous gravel which have elsewhere permitted of the investment of great amounts of capital to wash over with water brought from sources many miles distant, millions of tons of material to glean a profit from their scanty gold contents; but it may be stated confidently that the deposits here are much richer, and that they will prove more remunerative.

At the last session of the Legislature an Act was passed to allow of large tracts of ground being taken on almost nominal terms for a period of three months to permit of preliminary investigation for the purpose of alluvial mining. This arrangement permits capital to secure cheaply unbroken stretches of ground, which if found valuable can afterwards be brought under the regular conditions of the Mines Act.

Already applications have been made under this Act at Stormont, Meander and Nine Mile Rivers, and at Middle River, Inverness County. It is as yet too soon to know if this Act will be advantageous or not; at any rate the government has given every facility to those who believe that wealth can be extracted from the alluvial as well as from the underlying reefs.

In this connection it is interesting to note that indications of gold deposits are found in alluvials outside of the recognised or working gold fields of the Province. Gold has been found in this manner in Digby County, along the Cobequid Mountains, in the northern part of Guysboro County, and in almost every river flowing from the precambrian table land of northern Cape Breton. It is not known yet if this gold is derived from workable veins carrying free gold, from the schists which sometimes show gold, or from the oxidation of sulphurets which often form a considerable percentage of certain beds. At Middle River and Whycocomagh, in Cape Breton, free gold occurs

in the quartzites and in quartz veins in them. At the latter place it also occurs in the sulphides with which many of the felsites, etc., are strongly impregnated.

There appear to be two sources of alluvial gold in the province, first the free gold-bearing veins of the Atlantic coast, and the auriferous mineralised deposits, also in places containing free gold, and presented over a large section of the province, generally considered valueless for gold mining.

As these remarks may appear somewhat contradictory, I may briefly explain the facts. In Nova Scotia gold mining began in the free gold quartz veins, and may be said never to have left them. Any vein not showing free gold was pronounced valueless, and this early dictum has been accepted ever since as conclusive. It is true that the presence of free gold in the tailings of the stamp mills was known; however, it was resignedly put down as an inevitable waste accompanying that method of extracting gold. The presence of gold in the concentrates was repeatedly pointed out, but the average miner would not go to the expense of saving and treating them, or even of shipping them. The result is, that, as the most resourceful way of dealing with a useless substance was the cheapest method of getting it out of the way, the brooks, swamps and lakes in the vicinity of the stamp mills became the receptacles of the concentrates from the richest veins that have been worked in the province. Recently this opinion as to the value of the gold unseen by the miner has undergone a change, and it has been practically shown by Mr. W. L. Libbey, of the Brookfield Mine, Queen's County, that tailings and concentrates can contribute their quota to the miner's profit.

It can be readily understood that this long established opinion has not favored a search for gold and silver in other strata which have been mineralized by faults, intrusive dykes, etc. Now, however, the practical treatment of the residues of the quartz mills, and the presence of widespread signs of gold in alluvium and mineralized veins and zones outside of the free gold districts, has opened up a new field to the prospector; and, as in Cape Breton, he is availing himself of it.

HISTORY OF GOLD MINING.

The discoveries of the fabulous gold deposits of California and Australia had prepared the minds of Nova Scotians, and a tremendous excitement arose when the presence of gold in the province was

established. It is true that the first reports were listened to with incredulity by those in power, but public opinion, inflamed by the sight of the beautiful specimens from Tangier, compelled a legal recognition of the various districts.

The first claims were limited in size, and operators soon gave them up. Gradually companies acquired control of areas, put up mills, and started with high hopes. In many cases large profits were realized for a time in spite of every form of extravagance, of poor mills, and unskilled mining. This continued for a few years, when the laws of finance and mining resumed their sway. The veins opened on the richest points of the outcrop of their pay streaks gradually became too poor to pay; the treasuries of the companies, after lavishing dividends from the proceeds of the richest ore, had nothing left for a rainy day. There was nothing in reserve to pay for deeper shafts and larger machinery, and, the shareholders refusing to advance money in what appeared useless attempts to maintain mining, company after company closed down or passed into new hands.

The state of affairs cannot be better described than by an extract from the report of the Hon. R. Robertson for the year 1868:—

“The mining hitherto has to a great extent been done on the supposition that the quartz was in veins and not in beds, and when a rich spot is worked out or the vein narrows down, it is supposed that the mine is exhausted.

“A number of well paying mines have been abandoned at a depth where manual and horse power were no longer able to perform the necessary hoisting and pumping, the profits having been divided and no working capital set aside to meet contingencies. Commencing mines on a small area of ground has proved very detrimental, and there seems to be a mania for working shafts. As an instance, thirty shafts sunk on one lead in a distance of eighteen hundred feet, and twenty-three shafts in sixteen hundred feet on a lead not more than fifty feet distant. There is also a great lack of appliances and skill in saving the fine gold, and it is computed by good authority that at least thirty per cent. of it is lost in the tailings. In consequence of these drawbacks, all of which are remediable, it is a matter of general belief in this year 1868, that two or three years is the lifetime of a Nova Scotia mine.”

In 1870, we find from the Commissioner's report, that much the same state of affairs prevailed, and the miners are taken to task for their want of systematic mining.

In 1872 the state of affairs had very materially changed in one respect, the system of working the mines. The tribute system had come into practice, and company mining had been largely suspended. It became evident that many leads that were considered unworkable

by the directors of a company yielded a profit to a party of tributors. The chief objection to the tributors was the desultory nature of their operations, which in many cases led to the flooding and the crushing of the outcrops of good veins.

However, the tribute system marked the commencement of a new era. The enterprising men among the tributors, left to their own scanty resources, found that economy was the mainstay of mining. So by degrees high explosives, improved pumping and hoisting machinery, air drills, better systems of working, and last but not least great improvements in mills, and milling, were introduced, until the practice in Nova Scotia is fairly abreast of the times. As the success of many of the tributors became known, capital was gradually again available, and at the present time the greater number of the companies working in the province are successful whenever they have been started on a business basis and properly managed.

When companies have been formed to purchase and develop "prospects," they run their chances, and following the well known rule of all mining districts score more failures than successes. When however, in this province, a property has been developed enough to show a reasonable working chance, capital may be safely invested.

DISTRICTS.

It would occupy too much space to give a detailed notice of all the gold districts. I therefore give a very brief reference to the principal ones.

The best known districts are Wine Harbor, Stormont, Sherbrooke, Tangier, Montagu, Waverly, Renfrew, Oldham, Uniacke, Caribou, Brookfield, Whiteburn, Malaga, Fifteen Mile Stream, and Salmon River. Among others that have received more or less attention may be named Gegoggin, Ovens, Indian Path, Millipsisgate, Gold River, Kemptville, Gay's River, South Stewiacke, Gold Lake, Killag, Beaver Dam, Ecum Secum, Harrigan Cove, Cow Bay, Lawrencetown, Rawdon, etc.

More or less detailed notices of all these localities can be found in the reports of the Mines Department. In the case of the minor districts, as may be gathered from preceding remarks, their development has been retarded by the persistence of the prospector in

neglecting for years the problem of large supplies of low grade ore in favor of isolated rich veins.

WAVERLY.

Waverly was one of the earliest proclaimed districts. Rich boulders were found on "American Hill" in the fall of 1861, and shortly afterwards on Laidlaw's Hill, on the east side of the Waverly lakes. The latter place presented a valuable vein in a shape then new to miners, and attracted much attention. The vein was presented in a horse-shoe shape, with its apex pointing to the westward, and corrugated like logs of wood lying side by side. During the next three years about 5,000 tons of quartz were extracted by open work along the crop, and good average returns secured, with some extraordinary yields, in one case of 200 ounces from two tons. Finally the surface water proved too much for the individual operators, and the workings were abandoned for many years. At present these properties and others have been consolidated, and a tunnel driven in to cut the lode at the level of the lake. As at this level and for some distance lower it is auriferous, it is expected to again prove a valuable property. There are probably other unseen veins below this one which would give large backs above the level of the lake. In West Waverly the Burkner property was for some years a large producer, having yielded nearly a quarter of a million of dollars, as was also the DeWolf property, yielding about 9,000 ounces. Several companies on the American Hill were amalgamated in 1864, and yielded during that year a profit of \$90,000. Other small operators in some cases did fairly well. These results were all obtained from shallow workings, in no case exceeding 300 feet. Some years ago a deeper working was made on the Tudor mine, but operations were suspended, I am informed, on account of causes other than the quality of the ore. A commencement was recently made to reopen and deepen the workings on American Hill, and it is believed by those acquainted with the district that it offers a most promising field. Up to 1867 there had been a yield of about 40,000 ounces of gold from 56,758 tons of quartz, from a narrow strip running through the district. The total yield up to date is 61,308 ounces, from 122,346 tons of quartz, or about \$1,200,000.00.

MONTAGU.

The district of Montagu sprang into notice on the discovery of a boulder of quartz yielding \$1,600.00 of gold. This led to the opening

of the Lawson lode which, after a career unprofitable on an average yield of over two ounces to the ton, fell into the hands of the Lawson Brothers. They worked it for about five years and extracted 10,000 ounces. After lying comparatively idle for a number of years it is being successfully reopened by the Golden Group Company. This company also controls the Rose and DeWolf properties. The former was discovered by Mr. G. W. Stuart in 1879, and yielded large returns for some time, notably on one occasion 800 ounces from 80 tons of quartz. Finally it was lost on a fault.

The DeWolf property, after an uneventful career for some years, became known as the Annand Mine, and gave large returns for several years, when, owing to the death of the proprietor, little work was done until it came into the hands of the present owners.

The operations of the Golden Group Company as far as they have been carried, are highly satisfactory. The Symonds-Kaye property has been intermittently worked. In this district operations have been confined to the south dip of the anticlinal, and there is a large unworked but promising field on the reverse or northerly dip. The yield of the district to date is 39,071 ounces, valued at \$742,349.00, from 22,652 tons of quartz.

OLDHAM.

Work was begun in this district in 1862, and the following year saw eight crushers in operation. Up to 1884 an annual production of about 1,200 ounces was maintained, the yield in 1870 being 2,052 ounces from 2,644 tons of quartz. Among the leads worked during this period may be named the Britannia, Ohio, Sterling, Hall, Bonanza, Mayflower and Frankfort. At times very rich returns were made from small lots of quartz. Veins which passed obliquely from bed to bed were at one time quite extensively worked, and although small often gave rich returns, notably in one case 160 ounces from 10 tons of rock. The work in this district having been, during this period, largely in the hands of individual operators on small areas, the surface is greatly cut up, and the veins practically worked only along the outcrop. Some work was done on a cross lead in the eastern end of the district, and in 1883 the Dunbrack lode began to show valuable quartz. Operations were carried on briskly up to 1893, and the following returns were made:—

YEAR.	TONS.	OUNCES.
1885.....	1,170.....	2,360
1886.....	1,026.....	2,199
1887.....	2,357.....	2,599
1888.....	2,106.....	1,699
1889.....	1,391.....	2,709
1890.....	1,122.....	2,774
1891.....	2,019.....	2,909
1892.....	2,259.....	3,093
1893 (9 mos.).....	2,389.....	3,171

The operations of Mr. Hardman were profitable, and conducted with skill and economy; and this pleasing page in the history of this district is due to his enterprise and energy.

Operations in the leading mines were discontinued from causes other than the impoverishment of the properties, and little has been done since.

MOUNT UNIACKE.

Mining began here in 1867, and during the next few years several companies were working; however, the returns, which rose in 1868 to 3,247 ounces, were maintained for twenty years at figures varying from 100 to 1,700 ounces. During part of this time considerable attention was paid to the slate belts which were found to carry regular values over considerable areas. It may be found that in this district the best returns will be secured from these belts which often carry veins, auriferous, but not constant in their dimensions or values.

About this time an important discovery on the Withrow areas at South Uniacke diverted attention to the new district. A vein which yielded excellent returns was worked by the Withrow Company, and its extension was mined first by Thompson and Quirk, and afterwards by the Golden Lode Company. All these parties realized profitable returns. Interesting information on the system of mining, etc., carried on by Mr. A. A. Hayward at the Golden Lode mine, has been contributed by him to the proceedings of the Nova Scotia Mining Society. The history of this mine is instructive. After declaring numerous dividends from a rich strike which was followed about 1,800 feet from the surface, it was found that the streak increased in dimensions, but fell in value to about two ounces to the ton. Several thousand dollars were found to be needed to increase the production to maintain the gold output. However, the company would not do this, and the mine after standing for some time has passed into other hands.

RENFREW.

Work was begun here in 1862, but little was done until 1866, when the returns showed 6,423 ounces from 6,003 tons of quartz. The following year showed an increase of 1,500 ounces, succeeded by a decrease down to ten ounces in 1874. Since that date the yield has fluctuated up to 1,679 ounces. Among the earlier companies may be named the Hartford, Colonial, Ophir, Renfrew and McClure. In 1883 the Empress Company was started, and worked with much energy and ability. However, operations in the district have practically been suspended for some time.

This is one of the most promising districts in the province, and a part only of the belt has been explored. Judging from the gold in the surface soil there must be other leads in it worth working.

CARIBOU.

This name is given to a district lying to the south of the upper waters of the Musquodoboit River, and includes the two districts generally known as Moose River and Jennings, or Caribou. It was proclaimed in 1870, but mining had been carried on to some extent during the two previous years. The returns, although not large for a number of years, showed good averages, and in many cases proved satisfactory. The North, South, Hyde, Comstock and other leads were worked, often with good returns.

In 1881 the Moose River Gold Company carried on extensive workings, but they were abandoned, as the value of the leads opened diminished. Before closing, however, this company demonstrated that it had extensive deposits of low grade ore on its property. Since then large amounts of this low grade ore have been passed through their ten stamp mill by Mr. McGregor, and show an average of about six pennyweights to the ton. As these operations were profitable on a small scale there should be an opportunity for its systematic working. On the Touquoy and adjoining properties there appear to be similar supplies of low grade ore in addition to workable veins, which are being extensively developed by the Touquoy Gold Mining Company and others. The slate and surface earth of the Moose River district has received much attention so far, and with satisfactory results, even on a very small scale of working, and in this connection the following figures are interesting. There were crushed in the Moose River mill from 1881 to date, 30,640 tons of slate and low grade ore, with some lots of richer quartz, yielding 9,725 oz., 2 dwts. 21 grains, or an average of 6 dwts. 8 grs.

The returns made by Mr. Touquoy, from his ten stamp mill, from 1888 to 1898, including some lots of fairly rich quartz, show that 60,943 tons of slate and surface ground yielded 8,640 ounces, an average of about 2 dwts. 20 grains. This work yielded a uniform profit, and lower averages per ton will be shown further on to have also yielded a profit.

In Caribou in 1884 the Lake Lode mine was opened by Mr. Stuart, and worked by Mr. Wadsworth and by Mr. Saunders, and is now being extensively developed by the Guffey-Jennings Gold Mining Company. Large amounts of gold have been taken from this property, and a bright future is anticipated for it. In the same locality the Dixon, Truro, Hetherington, McDonald, Elk and other mines have been opened and worked successfully. The scheme for operating a number of these mines under one management, which is said to be in progress, should prove satisfactory, especially as a large mill in common for all would find abundance of low grade ore in addition to the proved veins. Up to date about 106,172 tons of quartz have yielded 40,805 ounces, valued at \$775,295.

SHERBROOKE.

This has been the most important of our districts, although it has had also its seasons of dullness. My space forbids any attempt to give the history of the operations that have been carried on here. Among the veins that have been worked may be mentioned the Cumminger, Hewitt, Hayden, Blue, Palmerston and Dewar. The following table shows the returns year by year from the district:—

YEAR.	TONS.	OUNCES.
1862.....	663.....	2,023
1863.....	3,454.....	3,304
1864.....	2,673.....	3,419
1865.....	2,511.....	3,424
1866.....	2,853.....	5,829
1867.....	7,378.....	9,463
1868.....	9,880.....	7,070
1869.....	11,500.....	5,546
1870.....	11,428.....	7,134
1871.....	13,882.....	6,579
1872.....	5,243.....	4,188
1873.....	7,187.....	5,026
1874.....	5,430.....	4,037
1875.....	6,443.....	5,818
1876.....	6,205.....	5,176

YEAR.	TONS.	OUNCES.
1877.....	8,654.....	8,237
1878.....	9,340.....	6,843
1879.....	9,209.....	7,389
1880.....	6,465.....	4,042
1881.....	5,277.....	2,580
1882.....	6,251.....	2,542
1883.....	8,470.....	3,356
1884.....	3,268.....	2,668
1885.....	2,426.....	1,238
1886.....	2,850.....	1,341
1887.....	2,413.....	585
1888.....	2,858.....	535
1889.....	1,618.....	243
1890.....	.....	.....
1891.....	464.....	119
1892.....	893.....	179
1893.....	.....	.....
1894.....	708.....	552
1895.....	3,397.....	1,942
1896.....	7,177.....	3,287
1897.....	12,659.....	4,181

representing a total value of about \$2,422,576.00.

The quartz mined in this locality has generally been of a high grade, and there can be no doubt that there are many more rich pieces of ground. The district moreover presents several localities which should be profitably worked on a low grade basis.

Crow's Nest and Cochrane Hill are included in this district, but have never contributed materially to its production. The search in these localities has been until recently for rich veins, when its capabilities for extensive low grade areas have been recognised. In this direction there is undoubtedly a future before them, as the numerous locally rich veins are accompanied in many cases by slates more or less mineralised.

WINE HARBOR.

This district for a few years during its early history yielded some good returns, but for a number of years past attempts at development have not been markedly successful. No reason can be given for this, as the geological conditions are apparently the same as elsewhere, and some of the veins were profitably productive. The total returns to date are 29,458 ounces from 43,322 tons of quartz.

SALMON RIVER.

This district was opened in the year 1880, and work commenced in 1881 with a twenty stamp mill driven by water power. The yield for that year was 1,758 ounces. The following year the Hattie mine was opened on what was believed to be the eastern extension of the Dufferin vein, but the operations were not long continued. In 1885 operations had reached a depth of 150 feet, and the vein had been followed for nearly a thousand feet, and the yield that year was 4,924 ounces from 10,880 tons of quartz. Increased power having been secured, the mill which had for some years contained thirty stamps, had its capacity increased by ten more.

This vein, which in structure is very similar to the saddle back veins met in the Bendigo gold district, Australia, has been one of much interest to miners. It showed at the surface, and on being followed down it divided, going down on each side of the anticlinal, and increased in thinness, giving in places over fifteen feet of crushing material. Under this folded vein cross cuts have shown the presence of other veins.

The working of the mine has been discontinued more or less during the past few years owing to change of ownership and litigation, but at the date of writing it is being reopened and provided with a thoroughly good equipment, and is expected shortly to resume its leading position among our gold mines.

The following are the returns received, almost exclusively from the Dufferin mine:—

YEAR.	TONS.	OUNCES.
1881.....	1,640.....	1,785
1882.....	3,460.....	4,315
1883.....	7,602.....	3,885
1884.....	9,799.....	3,397
1885.....	10,880.....	4,924
1886.....	11,628.....	6,509
1887.....	10,602.....	3,258
1888.....	9,925.....	3,354
1889.....	7,633.....	2,032
1890.....	6,415.....	2,070
1891.....	5,210.....	1,406
1892.....	4,220.....	1,042
1893.....	3,220.....	882
1894.....	.....	.....
1895.....	1,467.....	271
1896.....	.....	.....
1897.....	.....	.....

TANGIER.

This was the earliest district. For the first few years operations were much hindered by the numerous small areas held by individuals. The greatest production was during the years 1869-70-71, when 6,988 tons of quartz gave 5,099 ounces. During all other years the yield has been under one thousand ounces. Recent developments in the northern part of the district, and a short distance east of the Tangier River, promise a development on a larger and more permanent scale. The total returns to date are 20,491 ounces, valued at \$721,183, from 43,092 tons of quartz. In this are included the returns from the Mooseland mines in the northern part of the district, which has not yet received the attention it deserves.

FIFTEEN MILE STREAM.

This district, situated at the head waters of the Sheet Harbor River system, has always been largely an object of interest to the people of Pictou County. Its comparatively inaccessible position retarded its development for a number of years, but roads are now built into it, and during the past few years its undoubted value has been shown by the enterprise of New Glasgow capitalists. The following sketch of the principal mine operating in the district will be of interest:—

In 1886 the Egerton Gold Mining Company succeeded the Hall-Anderson Company at Fifteen Mile stream. They worked with a 10 stamp mill for four years and were fairly successful. In 1890 the "Egerton" sold out to the present proprietors, who organized the New Egerton company, and placed Mr. James A. Fraser in charge as manager. A new 15 stamp mill was at once erected, and the new company were soon on a good paying basis. During the first two years, (1890 and 1891,) nearly 4,500 ounces of gold were secured. Though operations were confined during the next two or three years mainly to developing the property, the yield of gold continued sufficient to meet all running expenses and pay for extensive improvements in machinery, etc. In 1893 an amalgamation was effected with the Stanley Gold Mining Company, which had been operating for some time in the district, and had erected a large dam and a 10 stamp water mill. During the years 1895-96, and the early part of '97, the company was particularly successful, the yield of gold for 2½ years *averaging* 225 ounces per month. In the summer of 1896 a new

30 stamp mill had been built, thoroughly equipped with new air compressor, etc. The first half of 1897 saw great attention paid to development work under the guidance of an experienced mining engineer. Notwithstanding this the mine continued yielding its regular returns till a severe crush in October caused a temporary abandonment of work. It was deemed advisable to resume operations on the open quarry system, and the past winter was spent in removing the surface and otherwise preparing for this new system of working. On May 1st operations were resumed, working on an open cut with a belt of over 120 feet.

A Ledgerwood overhead cable-way has been put in, succeeding the old fashioned tramways, as a carrier of rock to the mill. Ten additional stamps have been placed in the Stanley mill, which is now being operated with 20 stamps. This, with the 30 in the "Egerton" mill, makes a total of 50 stamps now operated by the company.

The property of the company embraces 300 mining areas at Fifteen Mile Stream, together with 4,000 acres of woodland from which fuel is obtained.

In 1896 the company was incorporated under the laws of Nova Scotia as the New Egerton Gold Mining Company, (Limited). Mr. James D. McGregor of New Glasgow, is president, and Mr. Geo. F. McNaughton is, and has been since 1895, resident manager. Mr. McNaughton's management of the property has been particularly efficient, and has been rewarded with pronounced success.

The returns of this company show that since their purchase of the Hall-Anderson Company property, 35,698 tons of quartz have yielded 17,617 ounces of gold.

Among the other districts that of Central Rawdon is interesting. Here the veins run across the measures, and two of them are found to unite in depth, thus reversing the method in which they are often presented in the other districts. Since 1880, 4,814 tons of quartz yielded 6,648 ounces of gold.

STORMONT.

The returns to date from this district show 48,522 ounces from 109,016 tons of quartz, etc. The history of this district for many years was similar to that given for the others. Some rich leads were worked profitably, and their abandonment left the district non-productive for a time. Attention has however been always directed to it as frequent rich returns were made from new veins, and numerous

indications of gold bearing veins were found over a tract several square miles in extent. Finally a new anticlinal system, known as the Richardson, was found to the north of the Mulgrave or Isaac's Harbor anticlinal. A number of mines have been opened on these and on the Country Harbor Narrows, and Forrest Hill anticlinals. The Doliver's Mountain and Richardson section present large and strong veins and belts, holding good gold values, and highly mineralized. There is undoubtedly room here for several mines like the Richardson, but worked with more attention to the tailings and concentrates. The workings of the Richardson mine, of which I give a few details further on, are of particular interest, as they have materially added to the proof that we can mine and work profitably deposits which a few years ago were considered beneath the miner's notice.

The output of the Richardson mine to date has been 12,327 ounces from 80,380 tons of quartz—and of the district, 48,522 ounces of gold, valued at \$921,918.00.

The following remarks from the paper by Mr. Andrews, referred to elsewhere in this report, are interesting:

"The Richardson belt is very heavily mineralized; and there is great cause for regret that only the free gold is saved. The results of a careful and elaborate series of tests of the tailings from this mine made by Mr. F. H. Mason, are somewhat surprising to many who do not consider the auriferous ores of Nova Scotia worth concentration. But facts speak loudly for themselves, and, much as we would like to have all our ore free milling, the desire does not alter the refractory nature of some of it.

"According to these tests, made when the ore being crushed was of an unusually low grade, the average loss was 1 dwt. 18 gr. per ton. A sample of tailings from which all the concentrates were not extracted gave 1.3% of concentrates, which had an assay value of 1 oz. 10 dwt. 1 gr. per ton, and still left a value of 1 dwt. per ton in the tailings. Another sample of tailings gave 6.3% of sandy concentrates, having an assay value of 1 oz. 1 dwt. 13 gr. per ton of concentrates. In neither sample was free gold or amalgam detected. The majority of the arsenical iron pyrites is contained in the slate; some samples of this slate assay very high. A chance sample gave the surprising result of 28 oz. 8 dwt. of gold to the ton of concentrates and yielded 30% of its total weight in concentrates. Two more assays of this slate gave concentrates valued respectively at 4 oz. 2 dwt. 8 grs. and 5 oz. 6 dwt. 12 grs. per standard ton of concentrates. As this slate contains so little free gold but a small portion of it is crushed.

"Near the surface the slate is soft and partly decomposed. In this condition it yields considerable free gold when milled. As the depth increases the slate becomes harder, increasing perceptibly in bulk, and in the quantity and quality of its concentrates. Below a

depth of about 100 feet it contains so little free gold that it is unprofitable as a free milling ore.

"An analysis of clear concentrates taken from the sluices of the mill gave the following composition :—

Silica.....	2.65
Iron.....	35.63
Sulphur.....	16.80
Arsenic.....	42.25
Copper.....	trace
Bismuth.....	"
Zinc.....	nil.

An assay of these concentrates gave 2 oz. 14 dwt. 21 gr. of gold per ton. A chlorination test of these concentrates obtained an extraction of 97% of gold contained.

"Being myself present when Mr. Mason made a great many of his tests and assays, and knowing the care that was taken with them, I cannot help feeling that it would be of general interest to those interested in gold mining in Nova Scotia to quote from Mr. Mason's report as follows :—

"It will be seen that you are losing a considerable amount of refractory gold in your tailings; you are dumping a considerable quantity of auriferous slate, and leaving a further and larger quantity in the mine, and finally you have a large tailing dump, parts of which would pay handsomely for working over. I am satisfied that the gold you are losing in your tailings is practically all in the form of concentrates. In churning up an ore (often heavily charged with mispickles) in the battery, you must of necessity at times flour a certain quantity of mercury; added to this, owing to the quantity of slate you are finely crushing, you have a very slimy tailing, consequently the floured mercury has little chance of re-settling, and small quantities are at times found to be carried away with your tailings.

"With a view to saving the refractory gold, I would strongly advise you to put in Frue vanners, use a coarse mesh screen, and cut down discharge to one half what it is at present. I would also increase the stamping capacity by increasing the number of drops from ninety, at which you are now running your mill, to one hundred drops a minute. In advising you to do this I wish to bring the following advantages you will gain to your notice :—

"1. You will be able to crush the whole belt, for your slate certainly contains refractory gold, and at times free milling gold. Your mine superintendent told me that he estimated that not more than one-third of the rock broken underground was milled, so, at the present time you are paying for breaking rock 66% of which you have not in the past milled, nor would I advise you to mill it unless you put in concentrators, and crush it only coarsely, for it is highly refractory, and if crushed finely it will flour mercury, and in that way probably carry away more gold than it contributes to the amalgam in the battery or on the plates."

"2. You will decrease your mining expenses by more than one-half; the only extra expense will be in hauling part of the slate, and in winding and hauling the remainder, while your output will be nearly three times what it is at present."

"3. I am of opinion that the slate will provide enough free gold to pay for the milling, in which case the concentrates will be all clear profit."

"4. You will dispense with the cost of picking the ore. I estimate that the cost of Frue vanners erected in Nova Scotia will be about \$150.00 per stamp. To get satisfactory concentration it will also be necessary for you to put in mechanical sizers, (the cost of which is small) and feed the coarse tailings on to one set of vanners and the fine on to another set."

"Having obtained your concentrates, chlorination is undoubtedly the method by which they should be treated. The cost of such treatment in Nova Scotia will, I estimate, be about \$4.00 per ton of concentrates. It will also be a matter for consideration whether the arsenic will be worth saving for two reasons, firstly, for its value, which is doubtful, and secondly to prevent its contaminating pasture lands and consequently prevent claims against you for poisoning cattle."

"The cost of an eight or ten ton chlorination plant erected in Nova Scotia will be about \$3,000, exclusive of building."

"Up to the present time this property has produced 43,000 tons of ore, which goes to show that the mining of low grade ores in Nova Scotia at a reasonable cost per ton, has got beyond the experimental stages and is a reality. The handling of the refractory ores has yet to be experimented with, and from the appearance of nearly all the ore I have seen along the Gold group anti-clinal, I am of the opinion that material for the experiment is not lacking."

Through the kindness of George A. Pyke, Esq., President of the Richardson mine, I am enabled to give the following interesting figures:—

HALIFAX, May 30th, 1898.

Dr. E. Gilpin, Inspector of Mines:

DEAR SIR,—

As promised, I beg to furnish you with an exhibit of the operations of above company for the past year, just closed, as follows:

FORTY STAMP MILL.

Total tons crushed.....	25,300 tons.
Total gold won.....	2,879 oz.
Product per ton.....	2 dwt. 6 $\frac{3}{4}$ gr.
Cost per ton, labor.....	\$1.15 $\frac{1}{2}$
" " " all charges, including renewals to machinery.....	\$1.83 $\frac{1}{2}$

For the past year, after providing and paying for every dollar of expenditure in connection with the running and thorough maintenance of the property in the highest state of efficiency, and leaving a balance of several hundred dollars on hand, the original shareholders have received dividends equal to $29\frac{1}{2}\%$ on their outlay.

Yours truly,

J. W. CRICHTON,

Secretary.

Cost of working and all expenses in connection with the "Richardson Mine," Isaac's Harbor, Nova Scotia, for month of May, 1898, embracing everything except insurance and wear and tear of machinery.

WAGES AS FOLLOWS:

14 Drill men.....	\$475 25	
23 Rock men.....	615 90	
4 Deck hands.....	102 00	
5 Quarry men.....	163 40	
2 Engine drivers at pit.....	83 70	
2 Timber men.....	66 70	
2 Brakesmen at pit head.....	61 80	
2 Trolley men " " ".....	59 85	
1 Foreman.....	48 00	
1 Night foreman.....	39 00	
2 Blacksmiths.....	96 20	
2 Teamsters.....	78 15	
1 Chief Engineer.....	55 00	
1 Amalgamator.....	51 00	
2 Engine drivers at mill.....	78 50	
2 Carpenters.....	68 40	
8 Mill hands.....	219 90	
Management.....	100 00	
		\$2,462 75

OTHER EXPENSES.

140 Tons coal.....	\$182 00	
19 Boxes candles, (570 lbs.).....	171 00	
Half jar quicksilver, (37½ lbs.).....	20 62	
Oil.....	10 00	
Wear of shoes and dies.....	50 00	
Cams and tappetts.....	50 00	
Waste.....	5 00	
Timber.....	10 00	
Shovels, picks, drills and handles...	15 00	
Dynamite, fuse and caps.....	111 57	
Horse feed.....	60 00	
Royalty.....	101 80	
Miscellaneous.....	25 00	\$ 811 99
Total.....		\$3,274 74

Total tons crushed	2,226,
Result of 25 days' crushing	
282½ ounces gold at	
\$19.00 per ounce.....	\$5,372 25
Cost per statement.....	3,275 14
Profit for May.....	\$2,097 11

A. B. COX,
Manager.

Isaac's Harbor, June 6th, 1898.

In the western part of the province Malaga, Brookfield, and Whiteburn have been the largest producers. These districts are comparatively new, and at first some very promising veins were opened and extensively worked, but little is now being done at Whiteburn and Malaga. Brookfield is interesting as it has the first chlorination plant built in the province. This was put up by Mr. W. L. Libbey and associates, and is run in connection with a valuable property owned by them. This plant has been in successful operation for some time. Mr. Libbey is prepared to treat, on reasonable terms, any parcels of concentrates that may be forwarded to him, guaranteeing an extraction of 90 per cent of the assay value. He is also prepared to make working tests of small quantities of ore as to their adaptability for chlorination, etc. This should supply a favorable opportunity to our gold miners to get information as to the values of their concentrates. Mining has also been carried on at Leipsigate, Gold River, Block House, and a number of other places in Lunenburg and Queens Counties, but they have not yet been worked on a scale commensurate with their promising indications. There is no doubt that all these districts would repay proper examination and development, as they differ in no respect, that I am aware of, from those opened to the east of Halifax.

MINING.

Reference has been made casually to the primitive and wasteful methods of gold mining which existed for many years in Nova Scotia. Gradually this has changed in the case of companies and individuals operating under the direction of competent mining engineers; although there is still a good deal of the prospect style of mining. Now, at many of the mines shafts are sunk at the proper places, and ground systematically blocked out, and the operations underground are carried on with economy and system. Properly designed machinery

is largely used for pumping, hoisting and crushing, and the mills are carefully built, and run with proper attention to the details essential to this metallurgical process, which is really much more complicated than would be believed from a casual glance at a mill. Interesting details on the best system of milling the quartz of this province are given by Mr. Hardman in a paper published in the transactions of the Nova Scotia Institute of Mining Engineers, for the year 1892-93. These transactions give many other interesting papers touching on gold mining practice in our gold fields. It can be said for the benefit of investors, that our gold mine managers can stand comparison with those of any other country in their ability to mine systematically, and to treat economically the extracted material.

To show this, I quote from a paper read by Mr. A. A. Hayward at the last meeting of the Nova Scotia Mining Society, in which he gave his experience in shaft sinking at South Uniacke and Montagu. At South Uniacke it was decided to sink a five feet six inch by twelve feet shaft 404 feet through hard quartzite. The work was completed in 140 days, of which 16 were occupied in timbering. The average rate sunk was 3.02 feet per day; the total cost of explosives per foot sunk was \$1.22; and the average monthly rate of sinking was 71 feet 6 inches, the highest rate being 85 feet in one month. The total cost, including management, fuel, and every thing chargeable to the shaft, was \$4,647, or \$11.50 per foot, the shaft being left completed, timbered, and ready for occupation.

At Montagu, during 1897, the shaft of the Golden Group Company was sunk 100 feet below the 200 feet level. The work would have been finished in 25 days, had several days not been lost in taking down and saving a small rich lode on the foot wall. The cost of this sinking per foot was a little in excess of that at Uniacke. These two instances show that the ordinary cost of sinking can be most materially reduced when the work is fully planned out, and carried on systematically.

A paper read by Mr. W. L. Libbey at the same meeting, gives some interesting figures as to his experience in mining and milling at Brookfield, Queen's County. He compares hand and machine drilling as follows:—

In making comparisons with the cost of landing ore at the rock-breaker on other mines, it must be remembered that the fissure vein at Brookfield averages not over 14 inches in width of crushing material. The extreme depth perpendicularly of the working of the mine is 450 feet. The figures given include the cost of sinking and drifting, and also in the first table is covered the cost of excavating a

large chamber to hold a double plunger Northey pump, and a cistern capable of holding mine water for 12 hours.

During six months, from May 1st, 1897, to November 1st, 1897, 5,606 tons of ore were sent to the mill at an average cost of \$2.54 per ton, as follows, for ore landed at the rock-breaker:

Labor (which includes blacksmiths & deck men) ..	\$11,173 99
Timber and poles	392 40
Shovels	35 20
Picks	20 60
Blacksmith's coal, 6 tons at \$10.66 per ton	63 96
Charcoal, 300 bushels at 15c. per bush.	45 00
Axes	5 00
Hoisting ropes (estimated).	50 00
Candles	364 29
Loss of steel	71 82
Fuel at pumping station and mill	1,046 00
Explosives	654 75
Iron, including rails for tracks.	126 70
Miscellaneous expenses	125 00
Lumber	45 00

Total

\$14,219 91

Some of my coal mining brethren will think coal is dear, but I am obliged to pay freight and teaming.

Following are the figures for three months of work with the Ingersoll Sargeant Air Plant. (And it should be borne in mind that not only have green men been broken in, but the method of stoping is being gradually changed from breast stoping to back stoping.) The results are especially gratifying to the Brookfield Mining Co., as many old timers have flatly stated that a small lead could not be worked as cheaply by an air plant as by hand labor, and in one instance recently an air plant has been discontinued and a return made to hand drilling. The months taken are January, February and March, 1898, during which time 2,840 tons were sent to the mill at an average cost of \$2.44 per ton, as follows, for ore landed at the rock-breaker.

Labor (which includes blacksmiths and deck men) ..	\$5,078 95
Timber and poles	198 80
Shovels	10 00
Picks	2 00
Blacksmith's coal, 4½ tons at \$10.66	47 97
Charcoal, 150 bushels at 15c.	22 50
Hoisting ropes	25 00
Candles	171 00
Loss of steel	11 25
Fuel at pumping station and mill	717 00

Carried forward

\$6,284 47

<i>Brought forward</i>	\$6,284 47
Explosives.....	512 50
Iron, including rails for tracks.....	43 45
Miscellaneous expenses.....	75 00
Lumber.....	25 00
Total.....	\$6,940 42

The result thus far is apparently to place our ore at the deck head ten cents per ton cheaper with an air plant than by hand work. We are, however, doing more than twenty-five per cent. of sinking and drifting with the air plant. In fact, it would be impossible to place men enough in the mine to equal by hand the work now done by power.

Following is a table showing the expense of running the 20 stamp mill for six months, commencing September 1st, 1897, and ending February 1st, 1898. During this time 5,910 tons of ore were milled and concentrated at an average cost of 63 cents:

Fuel.....	\$ 876 00
Labor—2 firemen.....	360 00
“ 3 amalgamators.....	900 00
“ 2 concentrator men.....	420 00
“ 1 carpenter.....	242 65*
“ 1 engineer.....	300 00
Miscellaneous expense, including lubricants.....	75 00
Cost total for shoes and dies.....	397 53
Mercury lost, 79½ lbs. at 60c.....	47 55
Screen wire, 192 ft. at 50c.....	96 00
Total.....	\$3,714 73

At the Richardson mine, Stormont, the lead has been found to be from 6 to 18 feet wide. In 1894 the mill contained 20 stamps, and the cost of mining and milling was \$2.90 per ton, inclusive of taxes, insurance, depreciation, and all charges. The belt was composed for the most part of one large lode from 1 to 4 feet in thickness, and a varying number of small lodes intermixed with slate. At places nearly the entire belt is quartz. The slate is auriferous as well as the quartz. Shortly after that date, the mine was remodelled in every respect, so that nine hand drills could produce regularly 2,000 tons of ore per month. The mill was enlarged to 40 stamps of 850 lbs. weight each, dropping 99 times per minute, and crushing very finely. With this plant, lighted by electricity, and driven by a central engine, the cost of mining and milling, including all charges, was \$1.65 per ton. The belt is very heavily mineralized, and the concentrates show gold up to 5 oz. per ton. The paper from which these brief extracts are given

was read by Mr. C. F. Andrews, at the Montreal meeting of the Canadian Mining Society in 1897. I may add that no attempt has yet been made at this mine to re-work the tailings and to save the concentrates; and undoubtedly had this been done from the first the profits would have been largely increased.

The climate presents no obstacles to mining, and operations are carried on throughout the year. There are no heavy falls of snow, and no heavy freshets, or rainy seasons. The mines themselves are with very few exceptions dry, and pumping charges are not heavy, when proper provision is made for diverting the surface water. All the districts are accessible by roads passable for heavy loads; some are close to railways; and many are on tide water, or only a few miles removed from it. Few, if any, gold mining districts are more favorably situated for procuring supplies. Mills, boilers, engines, and all the innumerable mechanical aids to mining are manufactured in the country, and within short distances of any district. Labor is plentiful. The men are quiet and orderly, and no communities are more law abiding than our mining villages, which are always provided with schools, and frequently with churches. The men are intelligent and good miners, and in the mining districts of Western America they are preferred to all others.

It will be observed from the preceding notes that there are three additional openings for extending the operations of the gold mines in this province: treatment of the tailings and concentrates, alluvial mining, and the development of what may be termed the gold in the mineralized deposits, in part only free milling.

As to the first of these openings, the treatment of the tailings and their concentrates, it may be remarked that its feasibility has been demonstrated at the Brookfield mine, and the reports of the assayers show an equally good opening for the treatment of this material by chlorination, or an allied process, in every district.

It is true that the expense of these plants may preclude their adoption by many of the smaller mines and districts. As however, the greater number of the districts are readily accessible by water or railroad, it would appear, that, if even the concentrates were saved and shipped to a chlorination plant, located at a convenient point, the government would receive an increased royalty, and many mines would have an important additional source of revenue secured to them. It is the generally expressed opinion of all who have looked into the matter that such a plant, for the treatment of concentrates, located at Halifax, would greatly benefit the mining community.

As to the second opening, the alluvial mining, I would only remark that this summer the problem is being tested at several points, and will, it is expected, be thoroughly worked out.

The subject of the third opening has as yet received comparatively little attention. It is known that at a number of places in the province, veins and beds, carrying as essential ingredients lead or copper ores, or both, contain gold and silver in amounts commercially valuable. It is also known that there are other localities in which there are deposits, sometimes showing free gold, which carry gold and silver in the sulphurets in amounts sufficient to warrant their reduction where the percentage of the concentrates is high enough. Localities coming under this latter classification occur in the Cobequid Mountains, in the counties of Pictou and Guysboro, and in northern Cape Breton. In the first and last named districts the streams show sights of gold, and a certain amount of free gold occurs. In the Whycocomagh, Middle River, and Cheticamp districts, there are extensive mineralised zones in the precambrian rocks, which present a good field for investigation. Free gold occurs in the alluvium in promising amounts; fine free gold is seen in the silicious beds, and the sulphurets carry gold. Given these data it would appear reasonable to expect that no great amount of prospecting should disclose localities for profitable mining. Examination will probably reveal points where a more particular enrichment has been caused by dykes, etc., and the mining developments of Western America will find a parallel in Nova Scotia.

CONCENTRATES.

Mr. F. H. Mason, Metallurgist, of Halifax, has kindly contributed to this report, a memo. on the tailings and concentrates of our Nova Scotia gold ores, as follows:—

Until the beginning of the year 1897 it may practically be said that no systematic attempt had been made to obtain anything but free milling gold from the ores of Nova Scotia. It is true that concentrators were erected at both Oldham and Waverly many years prior to this date, and were run at intervals, with very little measure of success. The class of machines used at both these places was the "Golden Gate," a machine requiring constant attention, and even then giving results far from being satisfactory. That the makers have ceased to manufacture it, is probably the best proof of its inefficiency. Notwithstanding the disadvantage resulting from the class of machine employed, the concentrates obtained in a custom mill at Oldham were

of such a high value, that it is surprising that attention was not given to the concentrating of tailings in other parts of the province at a much earlier date than last year. The average value of the concentrates obtained at Oldham was from sixty to seventy dollars per ton of 2000 lbs. I am given to understand, however, that no systematic record was kept of the per centage of concentrates saved, nor of the gold lost in the tailings after they had been over the concentrators.

At the Lake View Mines at Waverly, eight Frue Vanners were erected to treat the tailings from 30 stamps, or two-thirds the number required by good practice. So that here, although the class of machines was excellent, the number of machines was insufficient to handle the quantity of tailings going over them, and good results were consequently not obtained. The value of the concentrates, which at times contained a considerable proportion of sand, ranged from eight to thirty dollars per ton.

About 1881 W. A. Mirral of Colorado, started a chlorination plant at Waverly. The plant consisted of a very small hand roasting furnace, and a home made Plattner Chlorination plant of the crudest description. The whole thing proved a complete failure. Two years later B. A. Temple of Waverly joined Mirral, and put in a new furnace and new leaching and precipitating vats, &c., to start a Plattner plant. I have examined this plant and have never seen or read of any thing quite like it. How successful work could ever have been expected from it, is a little difficult to see. It is perfectly evident that those connected with the erection of the plant had not even an elementary knowledge of the business, and failure was the natural result.

The early attempts at cyaniding met with a fate similar to those of chlorination. Dr. Kendall and his assistants came from the States and erected a plant at North Brookfield, with a view to treating an old tailing dump at that time (about 1893) owned by the Brookfield Gold Mining Associates. Dr. Kendall experimented for some time without obtaining any results, and the Brookfield Associates who had employed him, gave him notice to quit, and continued the researches themselves for some time with no better results, and the attempt was abandoned.

These early failures naturally had a bad effect upon this branch of the gold mining industry, and gave the general public the false impression that even if the concentrates of Nova Scotia contained gold, it would cost more to extract it than the gold was worth, and the concentrates were allowed to go away with the tailings down streams and amongst brush wood, never to be recovered. At the time of my arrival in the province, it had become generally recognized that the ores of

Nova Scotia were free milling ores, and that gold which could not be saved in the mortars and on the plates of the stamp battery was not worth saving.

I at once turned my attention to studying this remarkable phenomenon, of a country with a large area of auriferous formation, in which all the gold was said to be of a free milling nature, with a view to establish either the truth or fallacy of this then generally recognized state of affairs. By obtaining samples of a number of old tailing dumps and making a number of careful assays of them, I soon discovered the complete error into which the gold mining fraternity of Nova Scotia had fallen. Assays of these samples gave from two dollars to seventeen dollars per ton. Of course in many cases a natural concentration had taken place, and these samples did not represent actual losses in the mill, but it did clearly prove to me that considerable quantities of gold were being lost, a large percentage of which might have been saved by the employment of proper machinery.

During the last five years I have made a large number of assays of tailings taken both directly from the end of the plates and also from dumps. I have also assayed a number of samples of concentrates.

The following table of maximum and minimum results from different districts will be of interest :

DISTRICT.	TAILINGS FROM PLATES.		TAILINGS FROM DUMPS.		CONCENTRATES.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
Cow Bay.....	1 dwt. 18 grs.	21 grs.	.....	.....	.....	.....
Sherbrook.....	3 dwt. 12 grs.	21 grs.	6 dwt. 10 grs.	3 dwt. 6 grs.	1 oz. 8 dwt.	1 oz. 8 dwt.
Caribou.....	2 dwt. 22 grs.	14 grs.	13 dwt. 2 grs.	2 dwt. 23 grs.*	12 oz. 0 dwt. 20 grs.*	2 dwt. 22 grs.
Uniacke.....	8 dwt. 4 grs.	21 grs.	.....	.....	13 oz. 3 dwt. 3 grs.	1 oz. 17 dwt. 21 grs.
Stormont.....	15 dwt. 8 grs.	1 dwt. 18 grs.†	16 dwt. 22 grs.	3 dwt. 6 grs.	136 oz. 1 dwt. 19 grs.*	1 oz. 7 dwt.
Brookfield.....	.....	.....	13 dwt. 1 gr.	14 grs.	12 oz. 17 dwt.	1 oz. 3 dwt.
Waverly.....	2 dwt. 15 grs.	21 grs.	6 dwt. 12 grs.	.....	4 oz. 14 dwt. 1 gr.	1 oz. 8 dwt. 7 grs.
Central Rawdon.....	2 dwt. 22 grs.	traces.	14 dwt. 17 grs.	4 dwt. 16 grs.	5 oz. 15 dwt.	1 oz. 2 dwt. 4 grs.
Wine Harbor.....	3 dwt. 12 grs.	1 dwt.	6 dwt. 17 grs.	3 dwt. 12 grs.	.....	.....
Tangier.....	1 dwt. 4 grs.	21 grs.	.....	.....	.....	.....
Fifteen Mile Stream.....	13 dwt. 10 grs.*	7 grs.	19 dwt. 20 grs.	7 dwt.	.....	.....
Oldham.....	.....	.....	.....	.....	3 oz. 8 dwt.	1 oz. 8 dwt. 4 grs.
Gold River.....	.....	.....	7 oz. 12 dwt. 20 grs.*	.....	.....	.....
Lunenburg County.....	.....	.....	.....	.....	99 oz. 16 dwt. 18 grs.*	21 oz. 1 dwt. 8 grs.*
Montague.....	8 oz. 2 dwt. 8 grs.†	1 dwt. 4 grs.	7 dwt.	.....	7 oz. 11 dwt. 16 grs.	5 oz. 9 dwt. 16 grs.

* Contained amalgam in appreciable quantities.

† Tailings from ore containing upwards of 40 per cent. mispickel.

‡ The ore was giving only \$2.00 in free milling gold at time the tailings were taken.

The results given in the foregoing table clearly show that the stamp mill only saves a part of the gold present in our Nova Scotia ores. It is true in many cases a greater percentage of gold might have been saved by more skillful crushing and amalgamation, but on the other hand it clearly shews the large amount of gold which is going to waste for the want of proper appliances to save it.

Concentrators have now been running for upwards of 12 months at Central Rawdon and at North Brookfield. At Central Rawdon the ore gives 4% of concentrates, having an average assay value of \$30 in gold and \$1 in silver. I am unable to give any values obtained at Brookfield, as the Brookfield Gold Mining Co., Ltd., refuse to give any information on the subject.

Another considerable source of waste in Nova Scotia gold mining is to be found in the waste rock dumps. At many mines it has been the custom to dump and stow away on the scaffolds nearly the whole of the slate rock mined, much of which is often auriferous. In a paper read by Mr. C. F. Andrews he gave assays made by myself of rock taken from the waste dump at the Richardson mine. These samples were not average samples of the dump, but were taken on account of the large proportion of mineral (mispickel) contained in them.

The following are the assays and per centage of concentrates:

1. Contained 30% of concentrates, having an assay value of 28 oz. 8 dwts. of gold per ton.
2. Assayed 11 dwt 2 grains per ton, contained 12.05 % of concentrates, having an assay value of 4 oz. 2 dwt. per ton.
3. Assayed 17 dwt. 0 grains per ton, contained 15 % of concentrates, having an assay value of 5 oz. 6 dwt. per ton.

Mr. Dimock milled a trial lot of slate rock taken from his scaffolds at the Central Rawdon mine which he had previously been in the habit of dumping and stowing. The result was a saving of 60 cents per ton in the mill, while the tailings contained \$2.60 per ton.

Undoubtedly many other mines might obtain similar results from material which at the present time is being piled on the waste rock dump or stored on the scaffolds under ground.

I have made a large number of experiments in my laboratory upon concentrates from all parts of the province, and up to now I have not come across a single instance in which any difficulty has been found in obtaining from 90 to 96 per cent. of the assay value by chlorination. Cyanide, on the other hand, has not proved so satisfactory. In one case I obtained a 94% extraction. With this exception 78% is

the best extraction I have obtained, while in many cases the extraction has fallen below 30%, even with prolonged treatment lasting over 30 days.

There are other sources of gold in Nova Scotia which up to now have received no attention. The stibnites of East Gore are highly auriferous, running at times over 50 ounces of gold per ton and shewing no free gold by panning. In several samples of copper pyrites I have found over half an ounce of gold per ton. The fahl ores of Cheticamp have assayed as high as \$15 in gold, while samples of rock carrying phyrrotite have at times run over half an ounce. All of these, especially the first named, will pay for further investigation.

The foregoing remarks of Mr. Mason are interesting and important, and should be carefully considered by our gold miners.

The following table shows the production of the Nova Scotia gold mines for a number of years. The annual production has varied from 7,275 ounces in the year 1862, the first year during which official returns were made, to the highest year 1867, which showed an output of 27,314 ounces. For some years past the production has been in the vicinity of the last named amount, altho derived from a much lower average yield per ton of quartz. Thus in 1867, there were 31,386 tons of stuff crushed for 27,314 ounces, while in 1897 there was a return of 26,579 ounces from 76,559 tons of stuff.

NOVA SCOTIA GOLD PRODUCTION BY DISTRICTS TO SEPT. 30, 1897.

DISTRICT.	Tons Crushed.	Total Yield. Ounces.	Value @ \$19.00 per oz.	REMARKS.
Caribou and Moose River.....	106,172	40,805	\$ 775,295	From 1869.
Montagu.....	22,652	39,071	742,349	" 1862.
Oldham.....	45,408	49,272	936,168	" "
Renfrew.....	48,142	33,869	643,518	" "
Sherbrook.....	185,789	127,504	2,422,576	" "
Stormont.....	109,016	48,522	921,918	" "
Tangier.....	43,092	20,491	389,329	" "
Uniacke.....	53,000	37,957	721,183	" 1866.
Waverly.....	122,346	61,308	1,164,852	" 1862.
Salmon River.....	95,601	39,373	748,094	" 1883.
Brookfield.....	22,436	14,900	283,100	" 1887.
Whiteburn.....	6,343	9,535	181,179	" 1887.
Lake Catcha.....	20,734	22,757	432,384	" 1882.
Rawdon.....	13,121	9,791	186,029	" 1887.
Wine Harbor.....	43,322	29,458	559,702	" 1862.
Fifteen Mile Stream.....	36,896	18,202	345,838	" 1874.
Malaga.....	18,567	15,180	288,425	1889-1893.
Other Districts.....	64,734	46,924	891,556	Since 1862.
Total.....	1,057,371	654,919	\$12,643,495	

NOVA SCOTIA LEAD ORES.

As yet little has been effected in the development of the ores of this metal in Nova Scotia. They occur principally in two geological horizons, the lower carboniferous or mountain limestone, and the precambrian or laurentian. As the former horizon in other countries has yielded productive deposits of Galena, some attention has been paid to it here in this respect. Observation has shown that at many localities lead ore is more or less distributed through the limestones. Among the places showing it may be mentioned the East and West Rivers of Pictou county; Gay's River and Musquodoboit, Halifax county; Smithfield and Pembroke, Colchester county; Milford Haven, Caledonia, and Salmon River, in Guysboro county; and numerous points in Cape Breton Island. At Gay's River it occurs over a large track of country, in limestone, disseminated in small crystals, in small nodules, and occasionally in thin veins. The average percentage at any place is small, and carries I believe up to 15 ounces of silver to the ton of lead. At Smithfield and Pembroke it occurs in greater quantity, and a considerable amount of exploratory work has been done. Here it is found in limestone also, apparently replacing it in part, and as a residual concentration from the removal of the rock. A very considerable amount of lead ore has been shown here at one point, but as the silver contents of the ore were not high, the low lead prices discouraged prospecting. It is, however, evident that in this district there are wide spread and promising galena ores, which merit much more attention than has yet been paid to them. In Musquodoboit, near the Crawford Settlement, pockets of ore in the granite have yielded lead carrying large amounts of silver.

At Caledonia, small veins of lead ore have received occasional attention. The ore is essentially galena, carrying from 15 to 18 ounces of silver to the ton.

Galena also occurs in considerable amount near Arichat, Richmond county, and on the head waters of the Gold and LaHave Rivers to the west of Halifax. The latter ores carried in some cases as much as 100 ounces of silver to the ton of lead, but, as far as I am aware, no attention has been directed to them. These ores are presumably in the precarboniferous rocks. On the Salmon River, and near Sydney, in the county of Cape Breton, galena also occurs in limestone, at the former place in considerable amount. Near Burnt and Boulacet

Harbours, on the Bras d'Or Lake, are quartz veins carrying galena, copper pyrites, etc. Samples have shown $18\frac{1}{2}$ ounces of gold and 97 ounces of silver to the ton. The adjoining rocks are in places heavily mineralised. On the North and Barasois Rivers of St. Ann's, in the county of Victoria, and several other places in this locality, in pre-cambrian rocks, are veins of quartz and zones of rock showing galena with copper pyrites, blende, etc. A sample of 900 lbs. of ore from McDonald's farm, one mile north of the bridge over the North River, yielded 155 lbs. of lead and 3 oz. of silver.

The most promising deposit of silver lead ore yet found is being developed at L'Abime Brook, Cheticamp, Inverness county, by S. M. Brookfield of Halifax and his associates. The ore occurs as a vein in the precambrian felsites, etc., and has been traced for several hundred feet, and where opened shows twenty feet of very high grade galena carrying a little copper pyrites.

Mr. Mason, of Halifax, states that, from assays made by him and by others, the ore carries an average of one ounce of silver to each unit of lead. Gold also occurs in some assays as high as 14 dwts. per ton, but it does not appear to be a regular constituent.

From his examination of the openings he considers that 50 tons of ore contains 5 tons of galena, and 1,500 lbs. of copper pyrites. This would yield, allowing for loss in dressing and smelting, 3 tons 1,200 lbs. of lead, and 360 ounces of silver, in addition to the copper. These figures, coupled with the accessibility of the mine, etc., etc., and the duty on lead, would indicate very promising results. Other deposits, of galena are reported in the same district, but as yet little work has been done on them. Galena ores occur northerly from the Cheticamp River, to beyond the McKenzie River, and native silver and carbonate of silver occur in the valley of the latter river and its tributaries. It is probable that the opening of the Cheticamp mine will lead to a careful prospecting of this district, and it is, I feel sure, from information that I have gathered for some years, one of the most promising localities in the province.

From these remarks it will be seen that the lead ores of the province are widely scattered, and have hitherto received little attention. It is very probable that the lower carboniferous limestones, which cover a great extent of country, may reasonably be expected to afford workable deposits at favorable points; for instance, in proximity to intrusive rocks of later date, or wherever they appear to have been in a position favorable to the concentration, aggregation, or deposition of such ores by aqueous agency.

NOVA SCOTIA COPPER ORES.

The remarks I have made about the lead ores of this province apply in a general manner to those of copper. The metal occurs frequently, in the metallic form, in veins and joints in the Triassic trap range running along the south shore of the Bay of Fundy, and in the isolated masses of the same mineral on the opposite side of the Bay. It also occurs in a similar manner in the consolidated ash accompanying the trap, and has been observed in the sandstones of the district, which are referred to the same geological horizon. As yet none of the deposits have, from the superficial tests hitherto made, appeared to be of permanent value. In some localities it is observed disseminated in the rock, and all such occurrences should be carefully tested. It is well known that in the Lake Superior district very small percentages of copper have yielded rich returns to the systematic and economical systems of mining and milling. It is true that the two districts differ widely from a geological point of view, but as both yield metallic copper in masses, etc., it does not appear unreasonable to expect, that here as at Lake Superior, it may be found in some localities, scattered in fine grains in the trap, in quantity sufficient to allow of its profitable extraction. Copper also occurs native in the Lochaber district, in Antigonish County, and at Cheticamp, Inverness County.

The carboniferous strata of Cumberland, Pictou, Colchester, Antigonish, and other counties, frequently show outcrops of nests and layers of vitreous sulphuret and green carbonate of copper, sometimes associated with coaly matter. Prospecting has shown these outcrops at Maccan, Wallace River Pugwash, Tatamagouche, Athol, Oxford, River John, Salmon River, Caribou, Durham and Waugh's River, in the counties of Cumberland, Colchester and Pictou. A few attempts have been made to work these deposits, but the ore although rich is variable and irregular in its occurrence, and work has been abandoned after the extraction of a few tons. A good deal of work has been done during the past two years on some defined beds of sandstone and shale, more or less uniformly impregnated with these and other ores of copper. Among these localities so tested may be named Doherty Creek, River Philip, Malagash Point, Fox Harbor, Gulf Shore, New Annan, Wentworth, and Henderson's Settlement in Cumberland County. The ores are also present at some points in beds of clay

resting on cupriferous sandstones, etc. Working samples are reported to have yielded as high as 18 per cent of copper, with in some cases small amounts of gold and silver. It is understood that the work of testing these deposits will be continued, as the parties interested have so far been much encouraged by the results. The numerous outcrops of the ores over so wide a tract of country warrant much more attention than has hitherto been paid to them.

At East Dalhousie, in Kings County, there are numerous shows of copper ore, which have hitherto been almost unnoticed. Copper pyrites occurs at Blandford, Lunenburg County, and at several points in Queens and Yarmouth Counties, and is commonly present, in small amounts, in the auriferous quartz veins of our gold fields.

The district extending from the head waters of the East River of Pictou, along the county line, to Polson's Lake, in Antigonish County, has yielded numerous indications of the presence of copper ores.

At the head waters of the East River specimens of copper ore occur with a gangue of carbonate of iron, but no attempt has been made to search for their source. In the vicinity of the Garden of Eden, there are veins of spathic iron ore, up to several feet in thickness, holding crystals of copper pyrites.

At Lochaber there are a number of veins carrying copper pyrites, and associated with diorite dykes. These veins have been prospected a little, and are apparently valuable, as the copper contents in the case of the largest vein, about six feet thick, were returned from large average samples at 19 per cent. From this point the cupriferous belt has been traced about four miles to Polson's Lake. Here the presence of large rich boulders instigated desultory prospecting for a number of years. Finally a vein of spathic ore, holding copper pyrites, was found in the year 1875, and traced several hundred feet. Its width, as proved by several shallow pits, varied from 6 to 11 feet. Large average samples yielded from 5.6 to 11.7 per cent. of copper. The distance of this district from a railroad and a shipping point, has apparently postponed indefinitely its development, although it is probably well worth the cost of a railroad. On the Salmon River, in Guysboro County, some veins were tested a number of years ago, containing copper pyrites and erubescite, and yielding as high as 39 per cent of copper. The age of the rocks holding these deposits in Pictou, Antigonish and Guysboro counties, is, I believe, determined as Devonian, and is in favor of their richness and permanence.

At Ohio, St. Joseph, Briery Brook, and other points in Antigonish County, deposits of copper ore occur at the junction of carboniferous

with older rocks. A little prospecting has shown small veins of rich ore, but as yet enough work has not been done to enable a correct idea to be formed of their extent.

The reports of Mr. Fletcher, of the Canadian Geological Survey, on the Island of Cape Breton, contain frequent references to copper ores. The following places may be mentioned: Benacadie, White Granite Hills, Gillis Brook, Spruce Brook, Irish Cove, East Bay, Washaback, Middle and North Rivers, French Road, Gillis Lake road, Mira, Cape North, etc.

At Washaback, the ores yielded in addition to the copper, gold up to about one ounce to the ton. At Eagle Head, in Gabarus Bay, Cape Breton County, several shafts have been sunk showing quite large beds, carrying mixtures of copper pyrites with other ores. Those acquainted with the operations consider that the deposits are well worth further examination.

At Cheticamp, Inverness County, there are numerous signs of copper deposits, and occasionally attempts have been made on a small scale to determine their value. This district shows copper ores over so large an extent of ground, that it is probable that this metal will be found present in workable amounts, as well as the lead already referred to. At George's River, near North Sydney, a little prospecting has been done on a very promising outcrop. On the Coxheath Mountains, a few miles to the south, a quite extensive development has shown the presence of several leads carrying copper pyrites, with some silver, from three to twelve feet thick. The copper contents of these beds vary from 3 to 10 per cent. from extraction of large lots. The shafts and levels have yielded several thousands of tons of good ore. Several causes, including financial ones as well as the low prices of copper, have retarded the development of this property; but as the outlook is now encouraging, arrangements are being made for working it.

In the Island of Cape Breton the copper ores occur in the precambrian felsites, etc., at Gabarus, Coxheath, George's River, Cheticamp, etc., and are found also in carboniferous strata.

These brief remarks on the occurrence of copper ores in Nova Scotia will show that they are very wide spread. They have as yet received almost no systematic examination, and local capital has preferred to venture in better known channels. It may, however, be justly claimed that the province presents, in several districts, unusually promising deposits, and that in better known and richer communities, they would before this have supported at least several profitable mines

The following table shows the average wages paid in the gold mines :—

	Per Day.
Engine drivers.....	\$1 50
Drill men.....	1 50
Drill helpers.....	1 25
Miners.....	1 40
Muckers.....	1 25
Deckmen, (laborers).....	1 25
Blacksmiths.....	1 75
Foremen.....	2 00
Mill men.....	1 25
Mill Foremen.....	1 75
Carpenters.....	1 50

The gold mines are acquired from the Crown on the following terms :—Licenses, comprising areas 250 by 150 feet, up to one hundred in number can be taken in one application. They cost at the rate of 50 cents per area, and are in force for twelve months. At any time prior to the expiration of the license any number of the areas included in it may be taken under a lease for forty years. The lease costs \$2.00 for each area included in it, and is subject to an annual rental of 50 cents per area, which is refunded if a certain amount of work is performed.

Licenses are issued to the owners of stamp mills, who are required to make returns under oath and to pay the royalty. The gold, for the purpose of royalty, is valued at \$19.00 per ounce; and the royalty is at the rate of two per cent. The average mint value of the gold is somewhat higher than \$19.00 per ounce. Provision is made for the free recording of all documents of titles, etc., in the mines office, for surveys, arbitration, etc.

The law is liberal, and every effort is made to meet the requirements of the mining fraternity.

In the case of copper and lead ores, licenses to search are issued, at a cost of \$30.00 for eighteen months, covering an area not exceeding 2 by 2½ miles. Out of this, during the term of the license, a lease of one-half a square mile covering either of these metals may be selected by the licensee. The lease is for four renewable terms of twenty years each, and is subject to an annual rental of \$30.00, refunded if royalty be paid exceeding that amount. These copper and lead leases carry the gold and silver associated with the copper or lead ores.

In compliance with your instructions I will not in this report proceed to consider the coal, iron ore, gypsum and other minerals found

and worked in Nova Scotia. It may, however, be appropriately remarked that an extensive development has been reached in the various coal fields, assuring the miner and metallurgist ample supplies of coal and coke for their operations. The iron ores are being worked, smelted, and converted into steel. The gypsum deposits are extensively worked. The quarries yield supplies of the best varieties of building stones, of limestone, marble, freestone, etc.

There are in addition mines of barytes, manganese, etc. In short the province, in proportion to its size, has been furnished by nature with an unusual and abundant variety of useful minerals; which it is regretted, have in many cases been allowed to remain undeveloped. Lumbering, fishing, and, until a few years ago, ship building and freighting, have absorbed the energies of local capitalists, and little attempt has been made to interest outside capital in any of our mines, except those of gold and coal. The field, however, for mineral investment in the province is being recognised as in many respects superior to that of other countries which have hitherto received so much attention from foreign investors, and the indications are that a short time will see the enquiries and investments of the past few years largely extended.

